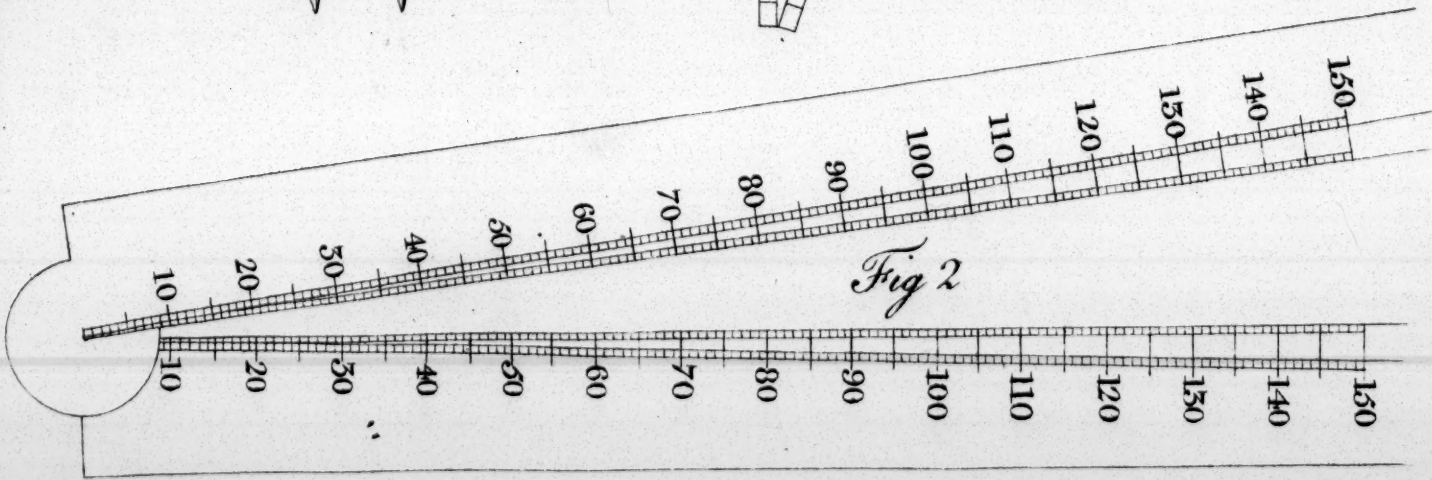
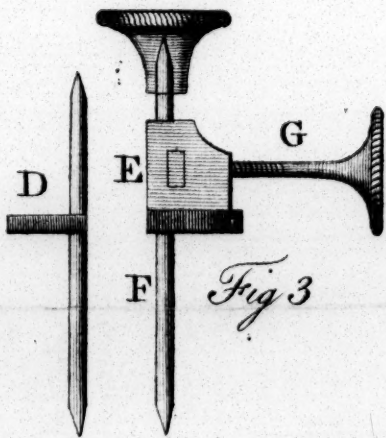
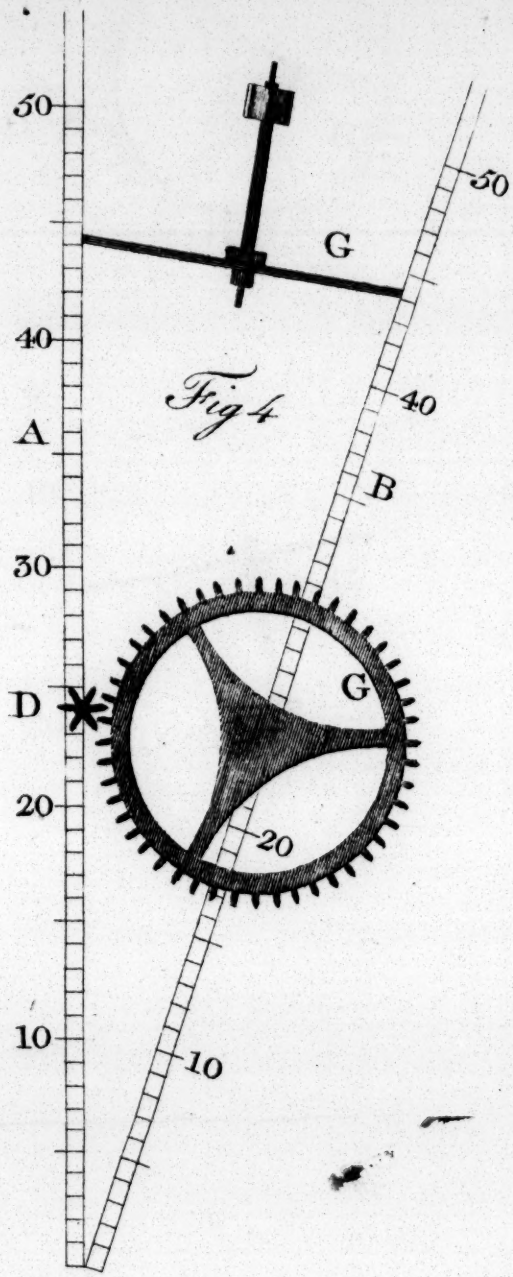
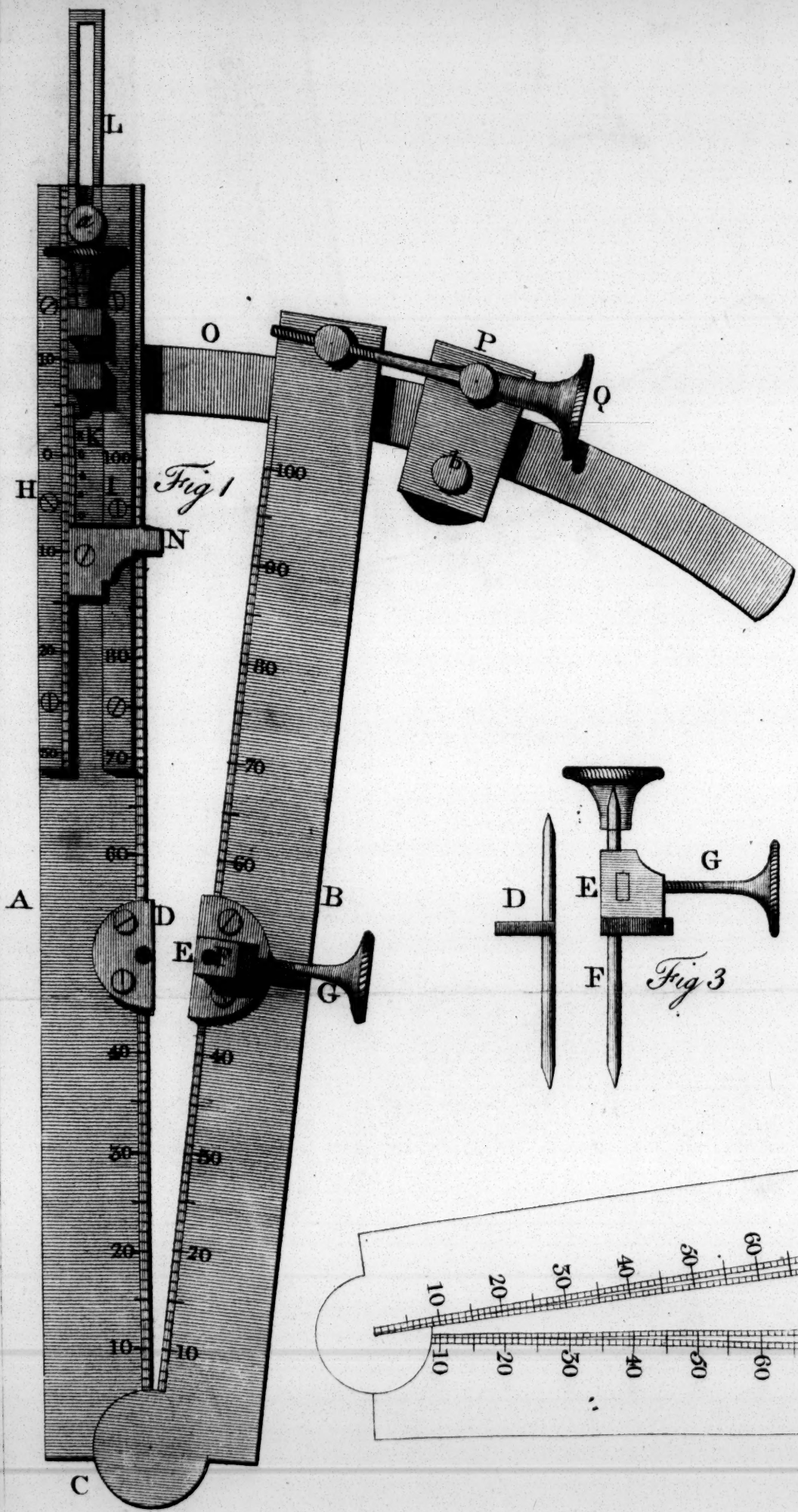




R. Pennington delin.



THE
DESCRIPTION
OF A
SECTOR,

FOR
Giving the proportionable Sizes of
WHEELS and PINIONS;

AND FOR
Determining the proper Distance of
their CENTERS from each other.

OF GREAT
Use to all CLOCK and WATCH
MAKERS.

Made and considerably improved by
R. PENNINGTON.

L O N D O N:

Printed for Mess. RICHARDSON and URQUHART,
under the ROYAL-EXCHANGE.
M.DCC.LXXX.

[Price ONE SHILLING.]

THE
CONSTITUTION

OF THE
UNITED STATES

OF 1787

As amended by the



and the

Supreme Court

of the United States

in the year

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THE
DESCRIPTION
OF A
SECTOR,
FOR

Giving the proportionable Sizes of
WHEELS, PINIONS, &c.

HAVING found, by repeated experiments; this instrument to be of very singular use, I have been induced to present it to the public; not only from a desire of its being farther serviceable to myself, but from the hope of extending its utility to the profession in general.

I do not claim the invention wholly to myself, the principle in some measure being taken from an Instrument invented by the late ingenious Mr. Downs: but finding this very inadequate to the purpose induced me to attempt an improvement: and, I fancy, I shall be excused in saying I have

succeeded in some degree, when it is considered that his answered no other purpose than simply giving the proper distance of the centers of a wheel and pinion, for the wheel to carry the pinion, (commonly called a proper depth,) by having the wheel given; and that only laid down on the instrument, by experiment, for wheels and pinions of every different number, at least as far as I have been able to learn; nor does it appear, from the principle upon which it is constructed, that there could possibly be any other method.

The sector, here offered to the public, gives, in the most accurate manner, the proportionable dimensions of wheels and pinions; also in drawing circles, and setting their centers at a proper distance in drawing callipers: this, I conceive, will be particularly useful; and which, I believe, has never been before attempted. It likewise gives the proper depth for a wheel and pinion, by only having the wheel given, with the help of the tables annexed.

The description, which I have here subjoined of the instrument and its different uses, together with the method of constructing the tables, I have endeavoured to make as intelligible as possible; and hope I have been so far successful as to enable any tolerable workman, with moderate attention, to make one from it himself.

Being

Being well assured of the great use of the Instrument, I am in hopes of seeing it adopted by men of skill in the profession, under whose hands I have not a doubt of its receiving much Improvement. The only objection that it seems liable to is, when a pinion is an improper size, or the leaves not a proper shape, it will not set them a good depth; but I will venture to affirm, from a number of experiments, that they must be exceedingly bad indeed before any sensible error will be perceived; and such as, I am sure, ought not to be admitted into any tolerable work: when this is considered, the objection will be of little weight.

The plate annexed represents the exact size of this instrument; and which, in my opinion, is of a good one for a watch-maker's purpose: the clock-maker will require one proportionably larger.

This sector is composed of the legs A and B, (fig. 1.) and the joint C, and divided into 100 (as appears by the figure) on one side, and on the other side into 150, in the manner shewn at fig. 2. At the 50th division, and having its center exactly on the edge of the leg A, is fixed the piece D; and on the same part of the leg B is fixed the socket E, with the moveable cylinder F going through it; and which may be fastened, at any place required, by the screw G. Figure 3

is another view of the socket, &c. the same letters refer to each. H and I (fig. 1.) are pieces screwed upon the leg A, having their edges next each other filed shelving, so as to form a dovetail groove, in which the pieces K and L slide; the piece L has a notch through it from one end to the other, to admit the piece *a*, which goes through both it and the leg of the sector, and has a nut screwed on the other side, to fasten it at any place; the pieces K and L are connected together by the screw M, the use of which is to set the piece K exactly to the place required: on this piece is screwed the piece N, which lies over the edge of the leg A; it has likewise on it a nonius of 10. O is an arch fixed to the leg A, and on which the end of leg B moves; P a piece fitted upon the arch O, and moveable upon it, and which may be fastened at any Place by the piece *b*, going through it, and having a nut screwed upon it on the other side; the piece P and the leg B are connected together by the screw Q, the use of which is to set the leg B exactly to the place required.

The use of the Sector.

I. To find the proportionable sizes of wheels and pinions.

LOOK for the number of the wheel on the Sector, then open it till the diameter of the wheel just reaches from one leg to the other, even with the number; the diameter of the pinion will then be even with the number in the small table annexed, as near as I have been able to come by a great many experiments.

Pinions.	Numbers on the Sector.
6	7.2
7	8.1
8	9.0
9	9.9
10	10.8
11	11.7
12	12.6

II. To draw circles the proportionable sizes of wheels and pinions.

THE line drawn from the center of the joint, and which is called the line of lines, or equal parts, and divided into 150, (fig. 2.) is for the

A 4

convenience

convenience of setting the compasses, to take the sizes, and answers the same purpose for circles as the edges of the sector does for wheels and pinions.

III. *To set the centers of circles at a proper distance from each other in drawing callipers.*

HAVING the numbers of the wheel and pinion, and the diameter of the wheel, look for the number opposite that of the pinion, in the small table annexed; and subtract that from the number of the wheel:

Pinions.	Numbers on the Sector.
6	3.8
7	4.6
8	5.7
9	6.4
10	7.0
11	7.7
12	8.3

This table is constructed by experiments with wheels and pinions, as appears by fig. 4. of the plate for pinions of six, the wheel 48 and pinion of six being at a proper distance and having their centers even with the 24th division, the diameter of the wheel touches the lines just 3 divisions and 8-10ths from the 48th division. The same rule will do for every other wheel.

For example. Suppose a wheel of 48 teeth and a pinion of 6 leaves: in the table, opposite 6, you find 3.8; which you subtract decimally from 48;

48.0
thus $\begin{array}{r} 48.0 \\ - 3.8 \\ \hline 44.2 \end{array}$ which produces 44 and 2-10ths; then

take the diameter of the wheel in your compasses,
set

set one foot on 44.2 on one leg, and open the sector till the other falls on the same number on the other leg; the distance then between half 48, on each leg, will be the distance of the two centers, for the wheel to carry the pinion, as appears by fig. 4. of the plate. A and B are the supposed lines, drawn apart from the sector, for the conveniency of having the wheel and pinion larger. G a wheel of 48; and D a pinion of 6.

IV. *To set wheels and pinions the proper depth in each other, by only having the wheels given.*

AT H (fig. 1.) are divisions corresponding with those on the edge of the sector, only numbered the contrary way, beginning at the 100th; and these are the divisions to be observed in this case: by means of the nonius, on the piece K, the edge of the piece N may be set the 10th part of one of the divisions, and answers the same purpose as if every single one were actually divided into 10; so that in using it for this purpose every single division must be called 10, the 10 a 100, &c. Suppose a wheel of 48 teeth and a pinion of 6 leaves to be set a proper depth, look in the table for pinions of 6, and opposite 48 you will find 79.1, which is 79 and 1-10th of the small imaginary divisions before mentioned; so that you set the cipher on the nonius as far beyond the 7th division

fion as till the 9th on it corresponds with one of the other divisions, (the fractional part in this case need not be taken notice of); then, if the wheel be applied to the edge of the sector, close to the piece N, and the legs be brought together until it reaches the same part on each leg, the points at D and F will then give the proper distance.

The method of constructing the following tables is thus: divide 1000 (which is the number the sector is supposed to be divided into) by the number of the wheel, and multiply this product by the number opposite to that of the pinion, in the table, p. 8; and this will be the number for that wheel. The sector may be divided into any number which may be judged most convenient; and the same rule will continue to answer in the construction of the tables.

TABLE

(II)

T A B L E I.

PINIONS of SIX LEAVES.

Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.
24	158.3	44	86.3	64	59.3	88	43.1
25	152.0	45	84.4	65	58.3	90	42.2
26	146.1	46	82.6	66	57.0	92	41.3
27	140.7	47	80.7	67	56.7	94	40.3
28	135.7	48	79.1	68	55.8	96	39.5
29	131.0	49	77.5	69	55.0	98	38.7
30	126.6	50	76.0	70	54.2	100	38.0
31	122.5	51	75.4	71	53.6	102	37.2
32	118.7	52	73.0	72	52.7	104	36.5
33	114.1	53	71.6	73	52.0	106	35.8
34	111.7	54	70.3	74	51.3	108	35.1
35	108.4	55	69.0	75	50.6	110	34.5
36	105.5	56	67.8	76	49.9	112	33.9
37	102.7	57	66.6	77	49.3	114	33.3
38	100.0	58	65.5	78	48.7	116	32.7
39	97.4	59	64.4	79	48.1	118	32.2
40	95.0	60	63.3	80	47.5	120	31.6
41	92.6	61	62.2	82	46.3	...	...
42	90.4	62	61.2	84	45.2	...	...
43	88.3	63	60.3	86	44.1	...	...

TABLE

T A B L E II.

PINIONS OF SEVEN LEAVES.

Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.
28	164.2	47	97.8	66	69.6	90	51.1
29	158.6	48	95.8	67	68.6	92	50.0
30	153.3	49	93.8	68	67.6	94	48.9
31	148.3	50	92.0	69	66.6	95	47.9
32	143.7	51	90.1	70	65.7	98	46.9
33	139.3	52	88.4	71	64.9	100	46.0
34	135.2	53	86.7	72	63.8	102	45.0
35	131.4	54	85.1	73	63.0	104	44.2
36	127.7	55	83.6	74	62.1	106	43.3
37	124.3	56	82.1	75	61.3	108	42.5
38	121.0	57	80.7	76	60.5	110	41.8
39	118.0	58	79.3	77	59.7	112	41.0
40	115.0	59	77.9	78	59.0	114	40.3
41	112.1	60	76.6	79	58.2	116	39.6
42	109.5	61	75.4	80	57.5	118	38.9
43	106.9	62	74.1	82	56.0	120	38.3
44	104.5	63	73.0	84	54.7	122	37.7
45	102.2	64	71.8	86	53.4	124	37.0
46	100.0	65	70.6	88	52.2	...	...

TABLE

(13)

T A B L E III.

P I N I O N S o f E I G H T L E A V E S .

Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.
32	178.1	52	109.6	72	79.1	104	54.8
33	172.7	53	107.5	73	78.0	106	53.7
34	167.6	54	105.5	74	77.0	108	52.7
35	162.8	55	103.6	75	76.0	110	51.8
36	158.3	56	101.7	76	75.0	112	50.8
37	154.0	57	100.0	77	74.0	114	50.0
38	150.0	58	98.2	78	73.1	116	49.1
39	146.2	59	96.6	79	72.1	118	48.3
40	142.5	60	94.9	80	71.2	120	47.4
41	139.0	61	93.4	82	68.5	122	47.2
42	135.7	62	91.9	84	67.8	124	45.9
43	132.5	63	90.4	86	66.2	126	45.2
44	129.5	64	89.0	88	64.7	128	44.5
45	126.6	65	87.5	90	63.3	130	43.7
46	123.9	66	86.3	92	61.9	132	43.1
47	121.2	67	85.0	94	60.6	134	42.5
48	118.7	68	83.8	96	59.3	136	41.9
49	116.3	69	82.3	98	58.1	...	...
50	114.0	70	81.4	100	57.0	...	...
51	111.7	71	80.5	102	55.8	...	...

TABLE

T A B L E IV.
PINIONS of TEN LEAVES.

Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.
40	175.0	58	120.6	76	92.1	108	64.8
41	170.7	59	118.6	77	90.9	110	63.6
42	166.6	60	116.6	78	89.7	112	62.4
43	162.7	61	114.7	79	88.6	114	61.4
44	158.0	62	112.9	80	87.0	116	60.3
45	155.0	63	111.1	82	85.3	118	59.3
46	152.1	64	109.3	84	83.3	120	58.3
47	148.9	65	107.4	86	81.3	122	57.3
48	145.8	66	106.0	88	79.0	124	56.4
49	142.8	67	104.4	90	77.0	126	55.5
50	140.0	68	102.9	92	76.0	128	54.6
51	137.2	69	101.4	94	74.4	130	53.7
52	134.6	70	100.0	96	72.9	132	53.0
53	132.0	71	98.8	98	71.4	134	52.2
54	129.6	72	97.9	100	70.0	136	51.4
55	127.2	73	95.8	102	68.6	...	...
56	124.9	74	94.5	104	67.3	...	...
57	122.8	75	93.3	106	66.0	...	...

TABLE

T A B L E V.

PINIONS OF TWELVE LEAVES.

Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.	Number of Teeth in the Wheel.	Numbers on the SECTOR.
48	172.9	65	127.4	84	98.0	118	70.3
49	169.3	66	125.7	86	96.5	120	69.1
50	166.0	67	123.8	88	94.3	122	68.0
51	162.7	68	122.0	90	92.2	124	66.9
52	159.6	69	120.2	92	90.2	126	65.8
53	156.6	70	118.5	94	88.2	128	64.8
54	153.7	71	117.2	96	86.4	130	63.3
55	150.9	72	115.2	98	84.6	132	62.8
56	148.2	73	113.5	100	83.0	134	61.9
57	145.6	74	112.1	102	81.3	136	61.0
58	143.1	75	110.6	104	79.8	138	60.1
59	140.6	76	109.2	106	78.3	140	59.2
60	138.3	77	107.7	108	76.8	142	58.6
61	136.0	78	106.4	110	75.4	144	57.1
62	133.8	79	105.0	112	74.1	...	...
63	131.7	80	103.7	114	72.8	...	...
64	129.6	82	101.2	116	71.5	...	...

THE END.

T A B L E V.
FININGS OF TWELVE LEAVES.

Number of the Section	Number of the Leaf	Number of the Leaf	Number of the Leaf	Number of the Leaf	Number of the Leaf	Number of the Leaf	
1	175.9	62	127.4	21	90.0	118	30.3
2	160.3	63	125.7	22	90.3	119	29.1
3	160.0	64	123.2	23	94.3	120	68.0
4	162.7	65	123.0	24	90.3	121	00.0
5	159.0	66	120.2	25	90.2	122	62.8
6	158.0	67	118.2	26	90.2	123	64.8
7	153.7	68	110.4	27	90.3	124	02.3
8	152.9	69	110.0	28	94.8	125	04.8
9	148.3	70	110.0	29	90.0	126	61.0
10	145.0	71	110.1	30	90.0	127	61.0
11	143.1	72	110.0	31	90.3	128	60.1
12	140.0	73	109.2	32	90.3	129	50.3
13	138.3	74	107.5	33	90.8	130	52.8
14	136.0	75	106.4	34	90.0	131	37.1
15	133.8	76	105.0	35	90.1	132	...
16	131.7	77	103.7	36	90.3	133	...
17	129.0	78	101.2	37	90.3	134	...



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